# Lab 6: Power Lab 1

Muscle physiology and Electromyography (EMG)

# Experiments and Objectives

**Voluntary Muscle Contraction** 

- Motor units and muscle physiology
- ➢ Regulation of muscle tension

**Recruitment and Frequency modulation** 

Antagonistic muscle function

Evoked (Involuntary) muscle contraction

- Physiology of an action potential
- Events at a neuromuscular junction
- Calculation of nerve conduction velocity

# Motor neuron and action potential(s)



An action potential, also known as a nerve impulse, is a short duration electrical current generated due to the movement of charged ions across the cell membrane of a neuron.

This current travels down the axon and terminates at the nerve endings.

#### Events at the Neuromuscular junction



Regulation of muscle contraction

- A muscle (e.g. : biceps) contains numerous muscle fibers.
- The muscle fibers are 'controlled' by motor neurons.
- Using differences in the size of the motor unit (i.e. the number of muscle fibers a single motor neuron controls) and the frequency of firing of these motor neurons, muscle contraction can be regulated in two ways:
  - Recruitment (of different motor units)
  - Frequency modulation

### Motor Unit Architecture



### Motor unit



#### **Recruitment and Size Principal**



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# EMG (Electro-myo-graph)

An EMG measures the electrical activity generated by a muscle fiber/motor unit during its contraction.



This electrical activity is displayed on the computer screen as a spike (change of voltage in the circuit).

Each spike is the combined electrical output of all motor units firing at that particular time.



**Size Principle**: smaller motor units are recruited before larger ones.

#### Voluntary EMG



#### Phases of a muscle contraction



### **Frequency Modulation**



#### Voluntary EMG

